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PERFORMANCE SPECIFICATION

FILTERS AND CAPACITORS, RADIO FREQUENCY INTERFERENCE, GENERAL SPECIFICATION FOR

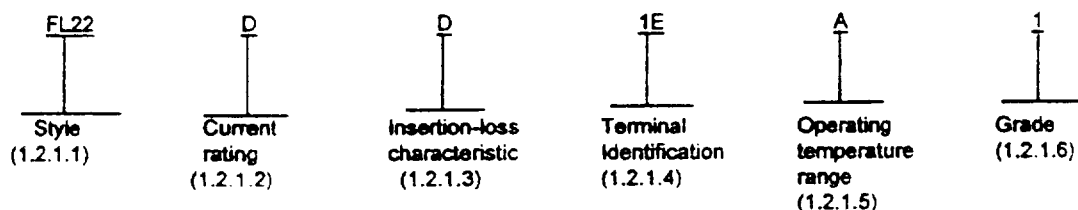
This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

* 1.1 Scope. This specification covers the general requirements for low-pass filters and capacitors used to suppress radio frequency/electromagnetic interference. Filters furnished to the requirements of this specification shall contain shunting capacitors and series inductors (FSC 5915). Capacitors furnished to the requirements of this specification shall contain shunting capacitors (FSC 5910). For the purposes of this specification, feed-thru capacitor types (C circuit configuration) shall be referred to herein as a filter. Passband power may be alternating current (ac) and/or direct current (dc) and the filter shall be used primarily in the reduction of broadband radio frequency interference.

1.2 Classification.

1.2.1 Type designation. The type designation shall be in the following form and as specified (see 3.1):



1.2.1.1 Style. The style is identified by the two-letter symbol "FL" followed by a two digit number. The letters identify radio frequency interference filters; the digits identify the general shape and mounting of the case.

1.2.1.2 Current rating. The current rating, at maximum operating temperature, is identified by a single letter in accordance with table I.

TABLE I. Current rating

Symbol	Rated current	Symbol	Rated current
	<u>Amperes</u>		<u>Amperes</u>
A	0.1	H	15.0
B	0.3	J	20.0
C	0.5	L	30.0
D	1.0	N	55.0
X	1.5	P	70.0
Y	2.0	R	100.0
E	3.0	S	150.0
F	5.0	T	200.0
Z	7.0	U	300.0
G	10.0	V	500.0
		W	As specified (see 3.1)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center, Columbus, 3990 East Broad Street, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

1.2.1.3 Insertion-loss characteristic. The insertion-loss characteristic is identified by a single letter in accordance with table II.

TABLE II. Minimum insertion loss under full load.

Symbol	Frequency in megahertz shown as column 1/ head and insertion loss shown in column									
	0.15	0.3	0.6	1	10	20	40	100	500	1,000
	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB
A	85	85	85	80	60	60	60	45	20	20
B	40	50	60	60	60	60	60	60	60	60
C	50	60	60	60	60	60	60	---	---	---
D	50	60	60	60	60	60	60	60	60	60
E	30	45	60	75	55	50	45	30	20	---
F	40	40	40	40	40	40	40	---	---	---
G	45	60	80	80	80	80	75	70	70	70
H	50	50	60	60	60	60	60	60	50	50
J	60	70	80	80	80	80	80	80	80	80
K	40	50	60	60	60	60	60	60	60	60
L	70	70	70	70	60	60	60	60	60	60
M	50	70	80	80	75	70	65	60	55	50
W	As specified (see 3.1) 2/									

1/ Full load insertion loss measurements shall be made from .15 to 20 MHz. Above 20 MHz, insertion loss measurements shall be made under no-load.

2/ W may also be used to indicate minimum insertion loss under no load (see 3.1).

1.2.1.4 Terminal identification. Terminals are identified by a number and a letter in accordance with table III. The number identifies the type of material and the letter identifies the thread (or other dimensions).

TABLE III. Terminal types and dimensions.

Symbol	Type of terminal	Thread or dimension
1E	Solder lug	---
2G	Radially tapped permanent stud	.164-32 UNC-2B
2H	Radially tapped permanent stud	.190-32 UNF-2B
3F	Threaded stud	.112-40 UNC-2A
3L	Threaded stud	.138-32 UNC-2A
3J	Threaded stud	.164-32 UNC-2A
3K	Threaded stud	.190-32 UNF-2A
3M	Threaded stud	.250-28 UNF-2A
3 UN	Threaded stud	.3125-24 UNF-2A
3P	Threaded stud	.216-28 UNF-2A

1.2.1.5 Operating temperature range. The operating temperature range is identified by a single letter in accordance with table IV.

TABLE IV. Operating temperature range.

Symbol	Temperature range
A	-65 to +85, incl °C
B	-65 to +125, incl
C	-65 to +200, incl
D	-55 to +125, incl
F	-55 to +85, incl
W	(As specified, see 3.1)

1.2.1.6 Grade. The grade is identified by a single digit in accordance with table V.

TABLE V. Grade.

Symbol	Vibration condition
	Hz
1	10 to 55, incl
2	10 to 500, incl
3	10 to 2,000 incl

2. APPLICABLE DOCUMENTS

2.1 Government specifications and standards. Unless otherwise specified, the following specifications and standards, of the issue listed in that issue of the Department of Defense Index of Specifications and Standards specified in the solicitation, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

L-P-378	-	Plastic Sheet and Strip, Thin Gauge, Polyolefin.
FF-S-85	-	Screw, Cap, Slotted and Hexagon Head.
FF-S-92	-	Screw, Machine: Slotted, Cross-recessed or Hexagon Head.
NM-P-71	-	Pallet, Material Handling, Wood, Stringer Construction, 2 Way and 4 Way.
QQ-C-533	-	Copper-Beryllium Alloy Strip (Copper Alloy Numbers 170 and 172).
QQ-S-571	-	Solder, Tin Alloy: Tin-Lead Alloy; and Lead Alloy.
QQ-S-781	-	Strapping, Steel, and Seals.
PPP-B-566	-	Box, Folding, Paperboard.
PPP-B-601	-	Boxes, Wood, Cleated-Plywood.
PPP-B-621	-	Boxes, Wood, Nailed and Lock-Corner.
PPP-B-636	-	Boxes, Shipping, Fiberboard.
PPP-B-676	-	Boxes, Setup.

MILITARY

MIL-P-116	-	Preservation, Methods of.
MIL-E-2036	-	Enclosures for Electric and Electronic Equipment, Naval Shipboard.
MIL-T-10727	-	Tin Plating; Electrodeposited or Hot-Dipped, for Ferrous and Nonferrous Metals.
MIL-C-14550	-	Copper Plating, (Electrodeposited).

(See supplement 1 for list of associated specifications.)

STANDARDS

FEDERAL

FED-STD-H28	-	Screw-Thread Standards for Federal Services.
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MILITARY

MIL-STD-105	-	Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129	-	Marking for Shipment and Storage.
MIL-STD-147	-	Palletized Unit Loads.
MIL-STD-207	-	Test Method for Electronic and Electrical Component Parts.
MIL-STD-220	-	Method of Insertion - Loss Measurement.
MIL-STD-794	-	Parts and Equipment, Procedures for Packaging and Packing of.
MIL-STD-1285	-	Marking of Electrical and Electronic Parts.
MIL-STD-45662	-	Calibration Systems Requirements.

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following document forms a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

ASTM D92-78 - Flash and Fire Points by Cleveland Open Cup.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheets. In the event of any conflict between requirements of this specification and the specification sheet, the latter shall govern.

3.2 Qualification. Filters furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.4 and 6.3).

3.3 Material (see 4.6.1). When a definite material is not specified, a material shall be used which will enable the filters to meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product.

3.3.1 Impregnating and potting compounds. Compounds used in the impregnating and potting of filters shall be chemically inactive with respect to the filter unit and the case (see 3.4.1). The compound, either in the state of original application or as a result of having aged, shall have no adverse effect on the performance of the filter. For oil-filled filters, the same material shall be used for impregnating as is used for filling.

3.4 Design and construction (see 4.6.1). Filters shall be of the design, construction, and physical dimensions specified (see 3.1).

* 3.4.1 Case. Filters shall be enclosed in metallic cases, unless otherwise specified, which shall protect the filter elements from moisture and mechanical damage under all test conditions specified herein. All external bonding or grounding surfaces shall be free from all insulating protective finishes.

3.4.2 Finish. All exposed metallic surfaces shall be suitably protected against corrosion by plating, lead-alloy coating, or other means. The finish shall provide good electrical contact when used on a terminal or as a conductor (see 6.4); shall have uniform texture and appearance; shall be adherent; and shall be free from blisters, pinholes and other defects that may affect the protective value of the coating. Solder-in filters shall have a copper underplate of 0.0001 inch (0.003 mm) minimum.

3.4.3 Threaded parts. Unless otherwise specified, all threaded parts shall be in accordance with FED-STD-H28. Where practical, all threads shall be in conformity with the coarse-thread series. The fine-thread series shall be used only for applications that might show a definite advantage through their use. Where a special diameter-pitch combination is required, the thread shall be of American National Form and of any pitch between 16 and 36 which is used in the fine-thread series. Screws shall conform to FF-S-85 or FF-S-92, as applicable.

3.4.3.1 Engagement of threaded parts. The length of all threaded parts shall be as specified (see 3.1).

3.4.4 Weight (when applicable). Filters shall be of the weight specified (see 3.1).

3.5 Creepage and clearance distances (when specified) (see 4.6.1).

3.5.1 Distances for nonaircraft, nonelectronic, electrical power equipment. The minimum external creepage and clearance distances between filter sections or between any filter section and ground shall be in accordance with table VI.

3.5.1.1 Creepage. Creepage distance is defined as the shortest path between uninsulated current-carrying parts along the surface of an insulating material. Cemented or butted joints do not add to the creepage path. Insulating barriers shall be used wherever practical to avoid a continuous unidirectional surface creepage path. It is to be emphasized that the values specified in table VI represent the minimum acceptable limits for nonarcing rigid construction and that they only take into consideration the average degree of enclosure and service exposure. Where such uninsulated parts are arc-rupturing or where there is any question of rigidity of mounting, higher voltage equipment, or exceptionally severe exposure, the minimum distances shall be increased as necessary, consistent with minimum space and weight requirements, to assure service reliability.

3.5.1.2 Clearance. Clearance distance is defined as the shortest point-to-point path in air between insulated current-carrying parts.

3.5.2 Relationship to enclosure. Group 1 enclosures (see table VI) are those which permit more transmission of air than drip-proof as specified in MIL-E-2036. For top-curved surfaces having a radius greater than 3 inches (76.20 mm) and for top-flat surfaces, surface-creepage distance in group 1 enclosures, shall be increased 33 percent where these surfaces have irregularities which permit the accumulation of dust and moisture. Group 2 enclosures (see table VI) shall be drip-proof as defined in MIL-E-2036 or permit less transmission of air than drip-proof.

3.5.3 Relationship to power.

3.5.3.1 Set A. Set A spacings shall be used in equipment where the effect of a short circuit is limited to the unit and where normal volt-ampere (VA) ratings up to 50 are involved.

3.5.3.2 Set B. Set B spacings shall be used for applications where secondary short-circuit protection in the form of fuses and circuit breakers is provided and where the normal operating VA ratings are over 50 and up to 2,000.

3.5.3.3 Set C. Set C spacings shall be used for applications having VA ratings in excess of 2,000 but still protected by secondary devices which can safely interrupt resultant short-circuit currents.

3.6 Seal (when specified) (see 4.6.2).

3.6.1 Liquid-filled units. When filters are tested in accordance with 4.6.2.1, there shall be no evidence of liquid leakage.

3.6.2 All other units. When filters are tested in accordance with 4.6.2.2, there shall be no continuous stream of bubbles emanating from the filter, nor shall there be any evidence of leakage of compound from the body of the filter.

3.7 Capacitance to ground (when applicable). When filters are tested in accordance with 4.6.3, the capacitance to ground shall be as specified.

3.8 Temperature rise. When filters are tested in accordance with 4.6.4, the temperature rise shall be as specified (see 3.1).

3.9 Dielectric withstanding voltage. When filters are tested in accordance with 4.6.5, there shall be no breakdown, flashover, or impairment of any characteristic qualities sufficient to cause failure of the filter.

3.10 Barometric pressure (reduced). When filters are tested in accordance with 4.6.6, there shall be no breakdown, flashover, or impairment of any characteristic qualities sufficient to cause failure of the filter.

TABLE VI. Creepage and clearance distances.

Voltage (ac or dc)	Set 1/	Clearance	Creepage 2/	
			Open, group 1 enclosures	Enclosed, drip-proof or better, group 2 enclosures
<u>Volts</u>		<u>Inch</u>	<u>Inches</u>	<u>Inches</u>
Up to 150	A	1/16 (1.59 mm)	1/16 (1.59 mm)	1/16 (1.59 mm)
	B	1/8 (3.18 mm)	1/4 (6.35 mm)	1/8 (3.18 mm)
	C	1/4 (6.35 mm)	3/4 (19.05 mm)	3/8 (9.53 mm)
150 to 300	A	1/16 (1.59 mm)	1/16 (1.59 mm)	1/16 (1.59 mm)
	B	1/8 (3.18 mm)	1/4 (6.35 mm)	1/8 (3.18 mm)
	C	1/4 (6.35 mm)	3/4 (19.05 mm)	1/2 (12.7 mm)
300 to 600	A	1/16 (1.59 mm)	1/8 (3.18 mm)	1/8 (3.18 mm)
	B	1/8 (3.18 mm)	1/4 (6.35 mm)	1/4 (6.35 mm)
	C	1/4 (6.35 mm)	3/4 (19.05 mm)	1/2 (12.7 mm)
600 to 1,000	A	1/8 (3.18 mm)	1/2 (12.7 mm)	3/8 (9.53 mm)
	B	1/4 (6.35 mm)	1 (25.40 mm)	3/4 (19.05 mm)
	C	1/2 (12.7 mm)	2 (50.80 mm)	1-1/2 (38.10 mm)

1/ See 3.5.3.

2/ See 3.5.2.

3.11 Insulation resistance (terminal to ground). When measured in accordance with 4.6.7, the insulation resistance of any filter section shall be not less than the applicable value shown on figure 1. The value of insulation resistance varies with temperature, and it is necessary to apply a correction factor to measurements made at a temperature other than 25°C. Correction factors for measurements made at temperatures between 20°C and 35°C are given in table VII. The required value of insulation resistance shall be multiplied by the correction factor to determine the new value required at the test temperature.

TABLE VII. Insulation-resistance correction factors.

Degrees Celsius	Correction factor	Degrees Celsius	Correction factor
20 ---	1.42	28 ---	0.82
21 ---	1.33	29 ---	0.76
22 ---	1.24	30 ---	0.71
23 ---	1.16	31 ---	0.67
24 ---	1.08	32 ---	0.63
25 ---	1.00	33 ---	0.59
26 ---	0.94	34 ---	0.55
27 ---	0.87	35 ---	0.51

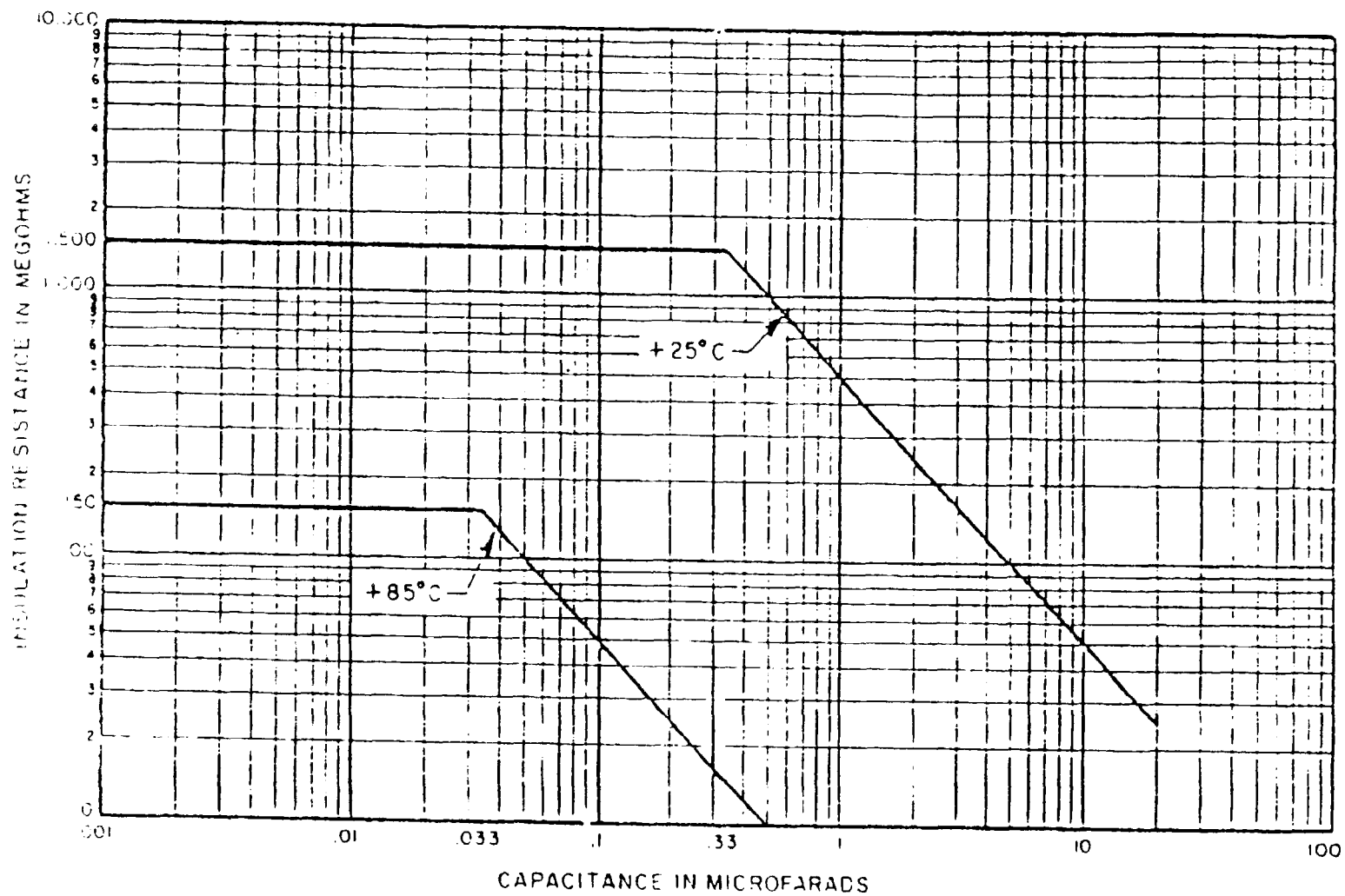


Figure 1. Graphical representation of resistance requirements.

3.12 Voltage drop. When filters are tested in accordance with 4.6.8, the voltage drop shall be as specified (see 3.11).

3.13 Insertion loss.

3.13.1 Full-load insertion loss (when applicable). When filters are tested in accordance with 4.6.9, the full-load insertion loss shall be as specified in table II.

3.13.2 No-load insertion loss (when applicable). When filters are tested in accordance with 4.6.9, the no-load insertion loss shall be as specified in table II.

3.14 Overload. When filters are tested in accordance with 4.6.10, the insulation resistance and voltage drop shall be as specified in 3.11 and 3.12, respectively. There shall be no physical damage to the filters.

3.15 Terminal strength. When filters are tested in accordance with 4.6.11, no part of the terminals shall loosen or rupture and no other damage shall result. Bends shall not be considered as damage unless an incipient break occurs.

3.16 Flashpoint of impregnant or potting compound (when applicable). When measured in accordance with 4.6.12, the flashpoint of the impregnant or potting compound shall be not lower than specified in table VIII.

TABLE VIII. Flashpoint of impregnant or potting compound.

Operating temperature range symbol	High operating temperature	Minimum allowable flashpoint
	°C	°C
A, E	85	145
B, D	125	165
C	200	240

3.17 Resistance to soldering heat (soldered terminals only). When filters are tested in accordance with 4.6.13, there shall be no damage to the filters or to the terminal insulators which will cause electrical failure of the filters, or which will cause hermetically sealed filters to leak. Chipping of terminal insulators alone shall not be cause for failure unless the chipping extends to the outer periphery.

3.18 Salt spray (corrosion). When filters are tested in accordance with 4.6.14, there shall be no harmful or extensive corrosion, and at least 90 percent of any exposed metallic surfaces of the filter shall be protected by the finish. The marking shall remain legible. In addition, there shall be not more than 10 percent corrosion of the terminal hardware or mounting surface.

3.19 Thermal shock and immersion. When tested as specified in 4.6.15, filters shall meet the following requirements:

Dielectric withstanding voltage - - - - -	As specified in 3.9.
Insulation resistance - - - - -	Not less than 30 percent of the value specified in 3.11.
Insertion loss (check test) - - - - -	As specified in 3.13.
Visual examination - - - - -	Corroded areas shall not exceed the limits specified in 3.18 and marking shall remain legible after the test.
Capacitance (when specified) - - - - -	Change not more than the value specified (see 3.1) from the initial value obtained when measured as specified in 4.6.3.

3.20 Shock, specified pulse. When filters are tested in accordance with 4.6.16, there shall be no evidence of intermittent, open or short circuiting, and no mechanical damage to the filter. The insertion loss shall be as specified in table 11.

3.21 Vibration. When filters are tested in accordance with 4.6.17, there shall be no intermittent open or short circuiting during vibration. After the test, there shall be no evidence of physical damage to the filters.

3.22 Moisture resistance. When tested as specified in 4.6.18, filters shall meet the following requirements:

Dielectric withstanding voltage - - - - -	As specified in 3.9.
Insulation resistance - - - - -	Not less than 30 percent of the value specified in 3.11.
Insertion loss (check test) - - - - -	As specified in 3.13.
Visual examination- - - - -	Corroded areas shall not exceed the limits specified in 3.18 and marking shall remain legible after the test.
* Capacitance (when specified)- - - - -	Change not more than the value specified (see 3.1) from the initial value obtained when measured as specified in 4.6.3.

3.23 Life. When tested as specified in 4.6.19, filters shall meet the following requirements:

Dielectric withstanding voltage - - - - -	As specified in 3.9.
Insulation resistance - - - - -	Not less than 30 percent of the value specified in 3.11.
Insertion loss (check test) - - - - -	As specified in 3.13.
Visual examination- - - - -	There shall be no visible mechanical damage.
* Capacitance (when specified)- - - - -	Change not more than the value specified (see 3.1) from the initial value obtained when measured as specified in 4.6.3.

3.24 Resistance to solvents. When filters are tested as specified in 4.6.20, there shall be no evidence of mechanical damage and the marking shall remain legible.

3.25 Solderability (when applicable).

3.25.1 Solderability of terminals. When filters are tested as specified in 4.6.21.1, the dipped surface leads shall be at least 95 percent covered with continuous solder coating. The remaining 5 percent of the lead surface may show only small pinholes or voids and these shall not be concentrated in one area. Bare base metal and areas where the solder dip fails to cover the original coating are indications of poor solderability, and shall be cause for rejection.

3.25.2 Solderability of mounting termination. When filters are tested as specified in 4.6.21.2, the joint shall be at least 95 percent covered with continuous solder coating. There shall be no evidence of leaching (loss of metallization). After the test, filters shall meet the following requirements:

Insulation resistance (+25°C) - - - - -	Shall meet initial requirements (see 3.11).
Capacitance - - - - -	Shall meet initial requirements (see 3.11).

3.26 Marking (see 4.6.1).

3.26.1 Full marking. Each filter shall be marked in accordance with method I of MIL-STD-1285 with the following information:

Example

a. Military part number.	M15733/74-0013
b. Manufacturer's source code.	ZZZZZ
c. Manufacturing date code and lot symbol.	12345 7311A
* d. Voltage rating and maximum operating temperature	600 V dc, 250 V ac 0 125°C
e. Current rating.	5 Ampere
f. Terminal identification or circuit diagram. (Non-symmetrical filters only)	L1
g. Maximum operating power frequency (for ac rated filters).	400 Hz.

3.26.2 Minimum marking. When the physical size of the filter precludes the marking of the information in 3.26.1, the minimum marking required shall be as specified in the specification sheet (see 3.1). In those cases where full marking requirements are not on the filter, the full marking shall be marked on the unit package.

3.27 Workmanship (see 4.6.1). Filters shall be processed in such a manner as to be uniform in quality and shall be free from cold soldering, corrosion (see 3.18), pits, dents, cracks, rough edges, misalignments, and other defects that will affect life, serviceability, or appearance.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-STD-45662.

4.2 Classification of inspections. The inspections specified herein are classified as follows:

- a. Qualification inspection (see 4.4).
- b. Quality conformance inspection (see 4.5).

4.3 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the "GENERAL REQUIREMENTS" of MIL-STD-202.

4.4 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.1) on sample units produced with equipment and procedures normally used in production.

4.4.1 Sample size. The number of filters to be subjected to qualification inspection shall be as specified in the appendix to this specification.

4.4.2 Inspection routine. Samples shall be subjected to the qualification inspection specified in table IX, in the order shown. All specimens shall be subjected to the inspection of group I. The samples shall then be divided into three groups as specified in table IX. The specimens shall then be subjected to the inspection for their particular group; for alternate-terminal-type submission, each type shall be equally represented in the group.

4.4.3 Failures. Failures in excess of those allowed in table IX shall be cause for refusal to grant qualification.

4.4.4 Retention of qualification. To retain qualification, the contractor shall forward a report at 6 month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall consist of:

- a. A summary of the results of the tests performed for inspection of product for delivery (groups A and B), indicating as a minimum the number of lots that have passed and the number that have failed. The results of tests of all reworked lots shall be identified and accounted for.
- b. A summary of the results of tests performed for periodic inspection (group C), including the number and mode of failures. The summary shall include results of all periodic inspection tests performed and completed during the 6 month period. If the summary of the test results indicates nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list.
- c. Actual group A, B, and/or C test data shall be supplied to the qualifying activity upon request.

Failure to submit the report within 30 days after the end of each 6 month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the 6 month period that the inspection data indicates failure of the qualified product to meet the requirements of this specification.

In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to product the item. If during two consecutive reporting periods, there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit his qualified products to testing in accordance with the qualification inspection requirements.

4.5 Quality conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B.

4.5.1.1 Inspection lot. An inspection lot, as far as practicable, shall consist of all the filters of the same style, current rating, insertion loss characteristic, terminal identification, operating temperature range, and grade produced under essentially the same conditions, and offered for inspection at one time..

4.5.1.2 Group A inspection. Group A inspection shall consist of the inspections specified in table X, in the order shown.

4.5.1.2.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality level (AQL) shall be as specified in table X. Major and minor defects shall be as defined in MIL-STD-105.

4.5.1.2.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

TABLE IX. Qualification inspection.

Inspection	Requirement paragraph	Test method paragraph	Number of sample units to be inspected	Number of defectives allowed <u>1/</u>
Flashpoint of impregnant or potting compound	3.16	4.6.12	---	0
<u>Group I*</u>				
Visual and mechanical examination: Material, design, construction, marking <u>2/</u> , and workmanship	3.1, 3.3 to 3.5.3.3, incl, 3.26 and 3.27	4.6.1	3/ 19	1
Seal - - - - -	3.6	4.6.2		
Capacitance to ground (when applicable)-	3.7	4.6.3		
Temperature rise - - - - -	3.8	4.6.4		
Dielectric withstanding voltage- - - -	3.9	4.6.5		
Barometric pressure (reduced)- - - - -	3.10	4.6.6		
Insulation resistance (terminal to ground)- - - - -	3.11	4.6.7		
Voltage drop - - - - -	3.12	4.6.8		
Insertion loss - - - - -	3.13	4.6.9		
Overload - - - - -	3.14	4.6.10		
Terminal strength- - - - -	3.15	4.6.11		
<u>Group II</u>				
Resistance to soldering heat (soldered terminals only)- - - - -	3.17	4.6.13	4	1
Resistance to solvents - - - - -	3.24	4.6.20		
Salt spray (corrosion) - - - - -	3.18	4.6.14		
Thermal shock and immersion- - - - -	3.19	4.6.15		
<u>Group III</u>				
Shock, specified pulse - - - - -	3.20	4.6.16	4	1
Vibration- - - - -	3.21	4.6.17		
Moisture resistance- - - - -	3.22	4.6.18		
<u>Group IV</u>				
Solderability (5 samples only) - - - -	3.25	4.6.21	10	1
Life - - - - -	3.23	4.6.19		

^{1/} A sample unit having one or more defects will be charged as a single defective.

^{2/} Marking will be considered a defect only if it becomes illegible as a result of the inspection.

^{3/} One additional sample unit is included in each sample of 19 to permit substitution for the allowable defective in group I.

*Nondestructive examination and tests.

4.5.1.3 Group B inspection. Group B inspection shall consist of the inspections specified in table XI, in the order shown, and the sample shall be selected from inspection lots that have passed group A inspection.

4.5.1.3.1 Sampling plan. The sampling plan shall be in accordance with MIL-STD-105 for special inspection level S-4. The sample size shall be based on the inspection lot size from which the sample was selected for group A inspection. The AQL shall be 4.0 percent defective.

TABLE X. Group A inspection.

Inspection	Requirement paragraph	Test method paragraph	AQL (percent defective)	
			Major	Minor
Visual and mechanical examination: 1/	---	4.6.1	1.0	4.0
Material - - - - -	3.3 and 3.3.1	---		
Body dimensions- - - - -	3.4	---		
Design and construction- - - - - (other body dimensions)	3.4 to 3.5.3.3 incl	---		
Marking- - - - -	3.26	---		
Workmanship- - - - -	3.27	---	1.0	---
Seal - - - - -	3.6	4.6.2		
Capacitance to ground- - - - - (when applicable)	3.7	4.6.3		
Dielectric withstanding voltage- - -	3.9	4.6.5		
Insulation resistance (terminal to ground) - - - - -	3.11	4.6.7		
Voltage drop - - - - -	3.12	4.6.8	1.0	---
* Insertion loss (check test)- - - - -	3.13	4.6.9		

1/ Visual and mechanical examination may be performed before or after the units are sealed, whichever is applicable.

TABLE XI. Group B inspection.

Inspection	Requirement paragraph	Test method paragraph
Temperature rise- - - - -	3.8	4.6.4
Overload- - - - -	3.14	4.6.10

4.5.1.3.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.5.1.3.3 Disposition of sample units. Sample units which have passed all the group B inspection may be delivered on the contract, if the lot is accepted and the sample units are still within specified electrical tolerances.

4.5.2 Periodic inspection. Periodic inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.5.2.5), delivery of products which have passed groups A and B shall not be delayed pending the results of these periodic inspections.

4.5.2.1 Group C inspection. Group C inspection shall consist of the inspections specified in table XII, in the order shown. Group C inspection shall be made on sample units selected from inspection lots which have passed groups A and B inspection.

4.5.2.2 Sampling plan.

4.5.2.2.1 Quarterly. Every 3 months, 10 sample units shall be subjected to the tests of subgroup 4 of table XII. Samples shall be selected according to style.

4.5.2.2.2 Semiannually. Every 6 months, 12 sample units (4 units for each subgroup) shall be subjected to the tests of subgroups 1, 2, and 3 specified in table XII. Samples shall be selected according to style.

TABLE XII. Group C inspection.

Test	Requirement paragraph	Method paragraph	Number of sample units to be inspected	Number of defectives allowed
<u>Subgroup 1</u>				
Insertion loss	3.13	4.6.9	4	
Barometric pressure (reduced)	3.10	4.6.6		
Salt spray (corrosion)	3.18	4.6.14		
<u>Subgroup 2</u>				
Shock, specified pulse	3.20	4.6.16	4	1
Vibration	3.21	4.6.17		
Moisture resistance	3.22	4.6.18		
<u>Subgroup 3</u>				
Terminal strength	3.15	4.6.11	4	
Resistance to soldering heat (soldered terminal only)	3.17	4.6.13		
Resistance to solvents	3.26	4.6.20		
Thermal shock and immersion	3.19	4.6.15		
<u>Subgroup 4</u>				
Solderability (5 samples only)	3.25	4.6.21	10	1
Life	3.23	4.6.19		

4.5.2.3 Defectives. If the number of defectives exceed the number allowed in table XII, the sample shall be considered to have failed.

4.5.2.4 Disposition of sample units. Sample units which have been subjected to group C inspection shall not be delivered on the contract.

4.5.2.5 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall notify the qualifying activity and the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, etc, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspection, or the inspection which the original sample failed, at the option of the qualifying activity). Groups A and B inspection may be reinstituted; however, final acceptance and shipment shall be withheld until the group C inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and the qualifying activity.

4.5.3 Inspection of packaging. The sampling and inspection of the preservation and interior pack marking shall be in accordance with group A and B quality conformance inspection requirements of MIL-P-116. The sampling and inspection of the packing and marking for shipment and storage shall be in accordance with the quality assurance provisions of the applicable container specification and the marking requirements of MIL-STD-129.

4.6 Methods of inspection.

4.6.1 Visual and mechanical examination. Filters shall be examined to verify that the materials, design, construction, physical dimensions, creepage and clearance distances, marking, and workmanship are in accordance with the applicable requirements. (See 3.1, 3.3 to 3.5.3.3, incl, 3.26 and 3.27.)

4.6.2 Seal (see 3.6).

4.6.2.1 Liquid-filled units (see 3.6.1). Liquid-filled filters shall be heated in an oven at the maximum operating temperature (see 3.1) for not less than three hours for filters weighing 20 pounds or less, and for not less than six hours for filters weighing over 20 pounds.

4.6.2.2 All other units (see 3.6.2). Filters shall be tested in accordance with method 112 of MIL-STD-202, and as follows:

- a. For filters having a maximum operating temperature rating of $+125^{\circ}\text{C}$: Test condition A or D.
- b. For filters having a maximum operating temperature rating of $+85^{\circ}\text{C}$: Test condition A or D except that the bath temperature shall be $+85^{\circ}\text{C} \pm 3^{\circ}$, -0°C .

4.6.3 Capacitance to ground (when applicable) (see 3.7). Capacitance to ground shall be measured in accordance with method 305 of MIL-STD-202. The following details shall apply:

- a. Test frequency. 1,000 \pm 100 Hz.
- b. Limit of accuracy. Within ± 2 percent.

* 4.6.4 Temperature rise (see 3.8). Filters shall be suspended by their terminals and shall be energized with rated current at maximum rated frequency in still air (see 3.1). Lead wires shall be of copper, 6 inches (162.40 mm) long, and of the size specified in table XIII. After thermal stability has been reached and while the filter is still energized, the maximum hotspot on the filter case shall be determined by the use of thermocouples. Lead wires specified in accordance with table XIII, shall be the smaller of the wire specified per table XIII or the actual wire size of the filter terminal.

TABLE XIII. Maximum lead wire size.

Rated current of filters		Wire size
<u>Amperes</u>		<u>AWG</u>
Up to 3	- - - - -	24
3* to 5	- - - - -	22
5* to 11	- - - - -	20
11* to 16	- - - - -	18
16* to 22	- - - - -	16
22* to 32	- - - - -	14
32* to 41	- - - - -	12
41* to 55	- - - - -	10
55* to 73	- - - - -	8
73* to 101	- - - - -	6
101* to 135	- - - - -	4
135* to 181	- - - - -	2
181* to 211	- - - - -	1

* 4.6.5 Dielectric withstanding voltage (see 3.9). Filters shall be tested in accordance with method 301 of MIL-STD-202. The following details and exceptions shall apply:

- a. Test voltage - Unless otherwise specified (see 3.1), the test voltage shall be dc and shall be as follows:
 - (1) DC rated only - 2.5X rated voltage.
 - (2) For filters with ac and dc ratings, - 2.5X rated dc voltage.
 - (3) AC rated only - 4.2X rated rms voltage.
- b. Duration of application of dc test voltage - 5 seconds minimum, 1-minute maximum, after the filter has reached thermal stability at maximum operating temperature produced by passage of rated current.
- c. Points of application of the test voltage - The test voltage shall be applied between the case (ground) and all live (not grounded) terminals of the same circuit connected together.
- d. Charging current - 50 mA maximum.
- e. The sensitivity of the breakdown test equipment shall be sufficient to indicate breakdown when at least 0.5 milliamperes of leakage current flows through the filter under test.

4.6.6 Barometric pressure (reduced) (see 3.10). Filters shall be tested in accordance with method 105 of MIL-STD-202. The following details shall apply:

- a. Method of mounting: Securely fastened by normal mounting means.
- b. Test condition letter: B.
- * c. Test during subjection to reduced pressure: Dielectric withstanding voltage as specified, except that the dc test voltage shall be 125 percent of the rated dc voltage, or 210 percent of the rated ac (rms) voltage if filter is only ac rated.
- d. Examination after test: Filters shall be examined for evidence of flashover, breakdown, or impairment which would cause failure.

4.6.7 Insulation resistance (terminal to ground) (see 3.11). Filters shall be tested in accordance with method 302 of MIL-STD-202. The following details shall apply:

- a. Test condition letter: A.
- b. Special preparations or conditions: Measurements shall be carefully made to prevent damage to the filter seal. When filters fail this test due to ambient relative humidity in excess of 50 percent, they may be retested at any relative humidity from 20 to 50 percent.
- c. Points of measurements: Between the case (ground) and all live (not grounded) terminals of the same circuit connected together.
- * d. Maximum charging current: 50 mA.
- * e. At the manufacturer's option, measurements can be made of the dc leakage current at the specified test voltage. The equivalent insulation resistance can then be calculated.

4.6.8 Voltage drop (see 3.12).

4.6.8.1 For filters rated ac only (see 3.1). The voltage drop is the difference between the input voltage to the filter and the output voltage of the filter when the filter is carrying rated current at rated voltage, with a resistive load at maximum rated frequency. The method of voltage measurement is shown on figure 2. Measurements shall be made by using expanded scale-type meters which will enable voltage differences of less than 1 volt to be read.

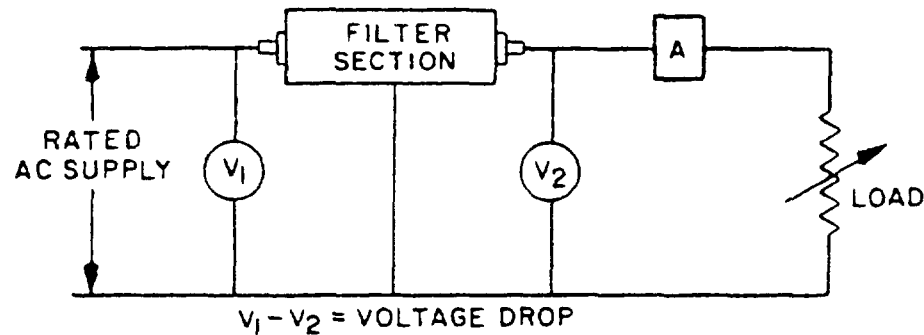


Figure 2. AC filters; measurements of voltage drop.

* 4.6.8.2 For filters rated dc only (see 3.1). The voltage drop shall be determined in accordance with figure 3. Measurements shall be made by using a dc reading meter when the filter is carrying rated current and rated voltage. At the manufacturer's option, the dc resistance can be measured in accordance with MIL-STD-202, method 303. The equivalent dc voltage drop can then be calculated.

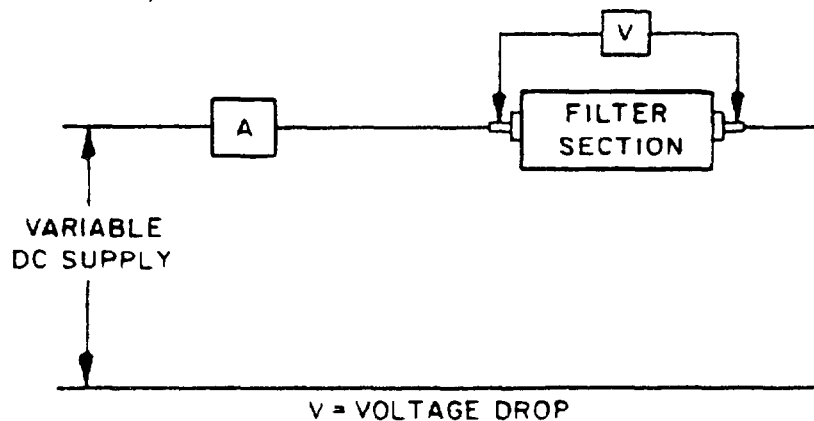


Figure 3. DC filters; measurements of series-element voltage drop at rate current.

* 4.6.8.3 For filters rated ac and dc (see 3.1). The voltage drop shall be measured as specified in 4.6.8.1 and 4.6.8.2, respectively. Both measurements must be taken for filters rated ac and dc.

4.6.9 Insertion loss (see 3.13).

4.6.9.1 Full-load insertion loss (when applicable). Filters shall be measured under load in accordance with MIL-STD-220, except that adapters may be modified to fit the particular style of the filter. Measurements shall be taken at a sufficient number of frequencies to plot a curve of insertion loss versus frequency, accurate to within ± 3 dB over the specified frequency range. Unless otherwise specified, all measurements shall be made at 25°C.

4.6.9.1.1 Full-load insertion loss (check test). Full-load insertion-loss measurements (any method accurate to within ± 3 dB) need be made only at the lowest and highest frequencies of the specified frequency range and at the one intermediate frequency; that is, the frequency at which the measured insertion loss (as determined from previous insertion-loss test, see 4.6.9.1) is closest to the minimum insertion-loss requirements.

4.6.9.2 No-load insertion loss (when applicable). Filters shall be measured in accordance with MIL-STD-220, except that adapters may be modified to fit the particular style of the filter. Measurements shall be taken at a sufficient number of frequencies to plot a curve of insertion loss versus frequency, accurate to within ± 3 dB over the specified frequency range. Unless otherwise specified, all insertion-loss measurements shall be made at 25°C.

4.6.9.2.1 No-load insertion loss (check test). No-load insertion-loss measurements (any method accurate to within ± 3 dB) need be made only at the lowest and highest frequencies of the specified frequency range and at the one intermediate frequency; that is, the frequency at which the measured insertion loss (as determined from previous insertion-loss test, see 4.6.9.2) is closest to the minimum insertion-loss requirements.

4.6.10 Overload (see 3.14). Filters shall be suspended by their conductors in free air at an ambient temperature of 20°C minimum. A current equal to 140 percent of rated current at maximum rated frequency shall then be applied for 15 minutes. After the filter has returned to room temperature, the insulation resistance and voltage drop shall be measured as specified in 4.6.7 and 4.6.8, respectively. Filters will be visually examined for evidence of physical damage.

4.6.11 Terminal strength (see 3.15). Filters shall be tested in accordance with method 211 of MIL-STD-202. Test condition A, B, or E shall apply as specified in the individual specification sheet. Terminals with external screw threads shall be subjected to the torque specified in table XIV.

4.6.11.1 Pull. A force of the specified magnitude shall be applied to the terminal at the point where the lead from the external circuit connects to it. The force may be applied in any direction, including the weakest, and shall be increased gradually to the specified magnitude and held at that value for at least 30 seconds (see 3.1).

4.6.11.2 Bend (applicable only to solder-lug terminals). Any terminal that shows visible bending in the terminal-pull test (see 4.6.11.1) shall be bent back and forth five times to an angle of 45° each side of center (terminal bend through an arc of 90°).

4.6.11.3 Twist. Terminals with external screw threads shall be subjected to the torque specified in table XIV.

4.6.12 Flashpoint of impregnant or potting compound (when applicable) (see 3.16). The flashpoint of the impregnant or potting compound shall be measured as specified in ASTM-D92-78. However, the paragraphs covering firepoint and precision do not apply to this test.

TABLE XIV. Terminal torque.

Screw size		Torque
		lb-in.
6-32	- - - - -	9
8-32	- - - - -	14
10-32	- - - - -	18
1/4-20	- - - - -	30
5/16-24	- - - - -	50
3/8-24	- - - - -	100
7/16-20	- - - - -	150
1/2-20	- - - - -	250
1/2-28	- - - - -	200
12-28	- - - - -	23
1/4-28	- - - - -	40

4.6.13 Resistance to soldering heat (see 3.17). Filters shall be tested in accordance with method 210 of MIL-STD-202. The following details shall apply:

- a. Depth of immersion in the molten solder shall be to a point $1/16 \pm 1/32$ inch ($1.59 \pm .79$ mm) from the insulation.
- b. Test condition letter: B.
- c. Cooling time prior to final examinations and measurements: 15 minutes. Capacitance to ground and coil continuity shall be checked 1 hour after immersion.

4.6.14 Salt spray (corrosion) (see 3.18). Filters shall be tested in accordance with method 101 of MIL-STD-202. The following details and exception shall apply:

- a. Test condition letter: As specified (see 3.1).
- b. Measurements after exposure: Not applicable.
- c. Visual examination: After the test, filters shall be visually examined for corrosion and obliteration of marking.

4.6.15 Thermal shock and immersion (see 3.19).

4.6.15.1 Thermal shock. Filters shall be tested in accordance with method 107 of MIL-STD-202. The following details and exceptions shall apply:

- a. Test condition letter: A, except the temperature at step 3 shall be the maximum operating temperature of the filter.
- b. Measurements before and after cycling: Not applicable.

4.6.15.2 Immersion cycling. Following thermal shock, filters shall be tested in accordance with method 104 of MIL-STD-202. The following details shall apply:

- a. Test condition letter: A.
- b. Measurements after final cycle: Dielectric withstanding voltage with 90 percent of the voltage specified in 4.6.5 applied for 5 ± 1 seconds, insulation resistance, and insertion loss (check test) shall be measured as specified in 4.6.5, 4.6.7, and 4.6.9, respectively.
- c. Visual examination: After the test, filters shall be visually examined for corrosion and obliteration of marking.

4.6.16 Shock, specified pulse (see 3.20). Filters shall be tested in accordance with method 213 of MIL-STD-202. The following details shall apply:

- a. Mounting: Securely fastened by normal mounting means. When applicable, leads and connecting wires must be supported to prevent damage to the filter.
- b. Test condition letter: K (30 g's).

- c. Test condition letter: 1 (100 g's).
- d. Electrical load during shock: During test, a potential of 100 percent of rated voltage shall be applied between terminals and case.
- e. After completion of the shock test, the units shall be subjected to the insertion loss (check test) as specified in 4.6.9.

4.6.17 Vibration (see 3.21).

4.6.17.1 Low-frequency (grade 1). Filters shall be tested in accordance with method 201 of MIL-STD-202. The following details and exception shall apply:

- a. Tests and measurements prior to vibration: Not applicable.
- b. Method of mounting: Securely fastened by normal mounting means.
- c. Duration of vibration: Three hours (1 hour in each direction).
- d. Electrical-load conditions: Rated voltage and rated current shall be applied continuously during vibration.
- e. Tests during vibration: Attached instrumentation shall be such as to indicate intermittent open- or short-circuiting.
- f. Examination after test: Filters shall be visually examined for evidence of physical damage and shall be subjected to the insertion loss (check test) as specified in 4.6.9.

4.6.17.2 High frequency (grades 2 and 3). Filters shall be tested in accordance with method 204 of MIL-STD-202. The following details and exceptions shall apply:

- a. Mounting of specimens: Filters shall be rigidly mounted by the body.
- b. Electrical-load conditions: As specified in 4.6.17.1d.
- c. Test condition letter: A for grade 2; B for grade 3.
- d. Tests during vibration: During the last cycle in each direction, an electrical measurement shall be made to determine intermittent open- or short-circuiting.
- e. Examination after test: As specified in 4.6.17.1f.

4.6.18 Moisture resistance (see 3.22). Filters shall be subjected to thermal shock as specified in 4.6.15.1. Filters shall then be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply:

- a. Mounting: Securely fastened by normal mounting means.
- b. Initial measurements: Not applicable.
- c. Polarization voltage: During steps 1 and 6, inclusive, a dc potential of 100 volts or rated dc volts, whichever is less, shall be applied between the terminals and case. The potential applied to the terminals shall be positive with respect to the case.
- d. Final measurements: Following the 24-hour conditioning period, dielectric withstanding voltage with 90 percent of the voltage specified in 4.6.5 applied for 5 ± 1 seconds, insulation resistance, and insertion loss (check test) shall be measured as specified in 4.6.7 and 4.6.9, respectively.
- e. Visual examination: After the test, filters shall be visually examined for corrosion (see 3.18) and obliteration of marking.

4.6.19 Life (see 3.23). Filters shall be tested in accordance with method 108 of MIL-STD-202. The following details and exceptions shall apply:

- a. The filters shall be separated from each other by a distance of not less than 1 inch (25.4 mm) during measurements.
- b. The filters shall be operated at maximum operating temperature.
- c. Filters shall be suspended by their terminals during the test.
- d. Test condition letter: B.
- e. Filters shall be energized with rated current at maximum rated frequency.
- f. During the test, radiant shields may be placed between units so that overheating of one unit will not affect a nearby unit.
- g. When both ac and dc voltage ratings are given, the ac voltage shall be used. The life test voltage shall be 1.2 times the rated ac voltage. Filters with only dc ratings shall be tested at 1.4 times the rated dc voltage.
- h. After the life test, dielectric withstanding voltage with 90 percent of the specified voltage applied for 5 ±1 seconds, and insulation resistance, and insertion loss (check test) shall be measured as specified in 4.6.5, 4.6.7, 4.6.9, respectively.

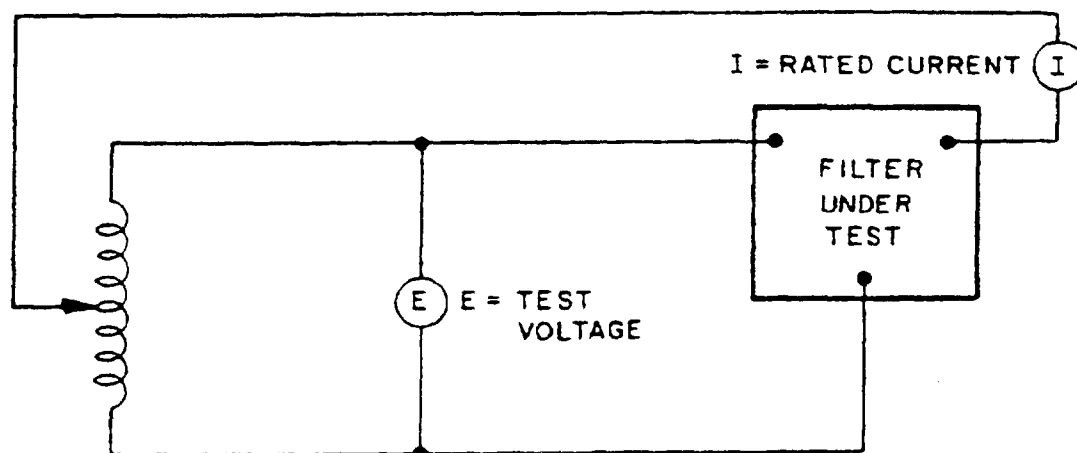


Figure 4. Typical life test circuit.

4.6.20 Resistance to solvents (see 3.24). Filters shall be tested in accordance with method 215 of MIL-STD-202. The following details shall apply:

- a. The marked portion of the filter body shall be brushed.
- b. Filters shall be visually examined for evidence of mechanical damage and legibility of marking.

4.6.21 Solderability (see 3.25).

4.6.21.1 Solderability of terminals. Filters shall be tested in accordance with method 208 of MIL-STD-202. The following details and exceptions shall apply:

- a. Number of terminations to be tested: 2.
- b. Special preparations of terminations: None.

4.6.21.2 Solderability of mounting termination (when applicable). Filters shall be tested as follows: (Note: The terminal solderability test (see 4.6.21.1) should be done with the filters already soldered to the test coupon; however, if the size of the solder pot or variations in the terminal preclude this sequence, the terminal solderability may be done first).

- a. Filters shall be soldered to the test coupon shown on figure 5. The filters shall be soldered with an iron at $253^{\circ}\text{C} \pm 7^{\circ}\text{C}$ using SN62WRMAP3 solder per QQ-S-571. The test coupon shall be preheated to $100^{\circ}\text{C} \pm 7^{\circ}\text{C}$. Heat should be applied to the coupon first in the immediate vicinity of the filter. The tip of the iron should then be moved so that it comes in contact with the edge of the filter for no more than 5 seconds or until a smooth solder fillet has been established around the filter. This sequence will be repeated with each filter.

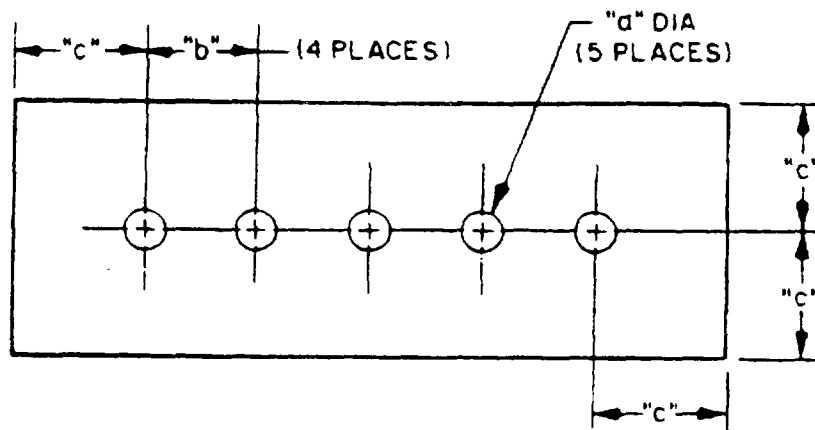


Figure 5. Test coupon for solderability of mounting terminations.

- b. Test coupon: Shall be in accordance with figure 5 and as follows:

- (1) Material: Beryllium copper per QQ-C-533, ALY (170), 0.014 ± 0.002 inch (0.36 ± 0.05 mm) thick.
- (2) Finish: Copper plate per MIL-C-14550, class 4 and tin plate per MIL-T-10727, type I, 0.0002 inch (0.01 mm) thick.
- (3) Dimensions: In accordance with figure 5 and as follows:

"a" = recommended mounting hole diameter as specified in the specification sheets.

"b" = 2 x the maximum filter body diameter.

"c" = "b" but not less than 0.50 inch (12.70 mm).

- c. Measurements after test: Insulation resistance (25°C) and capacitance shall be measured as specified in 4.6.7 and 4.6.3 while the filters are on the test coupon.

5. PACKAGING

- 5.1 Preservation. Preservation shall be level A, B, or C, as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning. Filters shall be cleaned in accordance with MIL-P-116, process C-1.

5.1.1.2 Drying. Filters shall be dried in accordance with MIL-P-116.

5.1.1.3 Preservative application. Preservatives shall not be used.

5.1.1.4 Unit packs. Each filter shall be unit packed one each in accordance with the methods of MIL-P-116 specified herein insuring compliance with the applicable requirements of that specification.

5.1.1.4.1 Hermetically sealed filters. Hermetically sealed filters shall be preserved method III.

5.1.1.4.2 Nonhermetically sealed filters. Nonhermetically sealed filters shall be preserved submethod IA-8. Each filter exceeding three inches in overall length or one inch in small overall dimensions shall be placed within a supplementary container.

5.1.1.5 Intermediate packs. Those filters, unit packed as specified in 5.1.1.4 and not requiring supplementary containers, shall be placed in intermediate containers conforming to PPP-B-566 or PPP-B-676. Intermediate containers shall be uniform in size, shape and quantities, shall be of minimum tare and cube and shall contain multiples of five unit packs, not to exceed 100 unit packs. No intermediate packs are required when the total quantity shipped to a single destination is less than 100 unit packs.

5.1.2 Level B. The level B preservation for filters shall be as specified for level A except that submethod IC-1 or IC-3 of MIL-P-116 shall be used in lieu of submethod IA-8.

5.1.3 Level C. The level C preservation for filters shall conform to the MIL-STD-794 requirements for this level.

5.2 Packing. Packing shall be level A, B, or C, as specified (see 6.2).

5.2.1 Level A. Filters, preserved as specified in 5.1, shall be packed in wood boxes conforming to PPP-B-601, overseas type or PPP-B-621, class 2. Closure and strapping shall be in accordance with the applicable container specification except that metal strapping shall conform to QQ-S-781, type I, finish A. The requirements for level B packing shall be used when the total quantity of a stock numbered filter for a single destination does not exceed a packed volume of one cubic foot.

5.2.2 Level B. Filters, preserved as specified in 5.1, shall be packed in fiberboard containers conforming to PPP-B-636, class weather resistant, style optional, special requirements. The requirements for box closure, waterproofing and reinforcing shall be in accordance with method V of the PPP-B-636 appendix.

5.2.3 Level C. Filters, preserved as specified in 5.1, shall be packed in fiberboard containers conforming to PPP-B-636, class domestic, style optional, special requirements. Closures shall be in accordance with the appendix thereto.

5.2.4 Unitized loads. Unitized loads, commensurate with the level of packing specified in the contract or order, shall be used whenever total quantities for shipment to one destination equal 40 cubic feet or more. Quantities less than 40 cubic feet need not be unitized. Unitized loads shall be uniform in size and quantities to the greatest extent practicable.

5.2.4.1 Level A. Filters, packed as specified in 5.2.1, shall be unitized on pallets in conformance with the MIL-STD-147, load type I, with a wood cap (storage aid 5) positioned over each load.

5.2.4.2 Level B. Filters, packed as specified in 5.2.2, shall be unitized as specified in 5.2.4.1 except that weather resistant fiberboard caps (storage aid 4) shall be used in lieu of wood caps.

5.2.4.3 Level C. Filters, packed as specified in 5.2.3, shall be unitized as specified in 5.2.4.2 except that the fiberboard caps shall be class domestic.

5.3 Marking. In addition to any special or other identification marking required by the contract (see 6.2), each unit, supplementary and exterior container and unitized load shall be marked in accordance with MIL-STD-129. The complete military or contractor's type or part number, as applicable (including the FSCM), shall be marked on all unit and supplementary packs in accordance with the identification marking provisions of MIL-STD-129.

5.4 General.

5.4.1 Exterior containers. Exterior containers (see 5.2.1, 5.2.2, and 5.2.3) shall be of a minimum tare and cube consistent with the protection required and shall contain equal quantities of identical stock numbered items to the greatest extent practicable.

5.4.2 Packaging inspection. The inspection of these packaging requirements shall be in accordance with 4.5.3.

5.4.3 Army acquisitions.

5.4.3.1 Level A and B unit and intermediate packs. In addition to that specified in 5.1.1.4 and 5.1.1.5, unit and intermediate containers shall either be weather or water resistant (e.g., variety 2 of PPP-B-566 or PPP-B-676) or overwrapped with the waterproof barrier materials. Intermediate containers shall not exceed 50 unit packs. Intermediate containers shall not be required when the total quantity to be shipped will result in only one intermediate pack per shipping container.

5.4.3.2 Level A and B packing. When the gross weight exceeds 200 pounds or the container length and width is 48 x 24 inches or more and the weight exceeds 100 pounds, 3 x 4 inch skids (laid flat) shall be applied in accordance with the requirements of the container specification.

5.4.3.2.1 Unitization. Unitization shall be required when the containers specified in 5.2.1 and 5.2.2 do not require skids; quantities per destination exceed either a total of 250 pounds (excluding the pallet) or a volume of 20 cubic feet; and the container size permits use of one of the pallet patterns of MIL-STD-147. A quantity of containers, packed as specified, except that container strapping may be omitted, shall be placed on a pallet, load type I conforming to MIL-STD-147. For level B, unit containers which meet these requirements may be palletized without further packing. The pallet shall conform to NW-P-71, type IV, group I or II woods. The load shall be "bonded" to the pallet by strapping conforming to QQ-S-781, type I, finish A, or shrink film conforming to L-P-378, type IV. Stretch wrap in accordance with MIL-STD-147 is authorized for shipments within the continental United States and for containerized shipments.

6. NOTES

6.1 Intended use. Filters described herein are intended to be used in the reduction of broadband radio frequency interference.

6.1.1 Insertion loss. The test method specified in MIL-STD-220 for measuring insertion loss provides data that is valid if the actual source and load impedances are both 50 ohms resistive. Power-line filters are normally used under conditions where source and load impedances are independent of each other and can vary widely as a function of frequency. In addition the power source impedance generally varies from line-to-line. Therefore, MIL-STD-220 insertion loss results should not be assumed to be entirely valid in a particular application; in fact, ringing or filter gain may occur under certain conditions of mismatch.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Title, number, and date of the applicable specification sheet, and the complete military part number (see 3.1).

NONSTANDARD FILTER
DRAWING EVALUATION CHECKLIST

Drawing no. (FSCM) _____	Adequate	Inadequate (see notes)	Missing	Not applicable
Vendor part no. (FSCM) _____				
Filters acquired to this drawing meet all the requirements of MIL-F-15733 and as specified herein. In case of conflict this drawing takes precedence.				
Vendor part number on drawing				
Vendor FSCM on drawing				
Circuit configuration (diagram)				
Case, terminal, and mounting dimensions				
Weight				
Marking				
Operating temperature range				
Voltage, operating (with frequency range)				
Current				
Insertion-loss* (at least six frequencies)				
Insulation resistance 020° - 25°C @Max operation temperature				
Voltage drop ac (rms) dc				
Capacitance to ground (-0, +100 percent)				
Terminal strength				
Temperature rise				
Salt spray				
Shock (test condition K or I)				
Vibration				
Quality assurance provisions				
To be in accordance with DoD-STD-100 this drawing is correctly designated:				
Should be designated as: <input type="checkbox"/> Specification control drawing <input type="checkbox"/> Source control drawing <input type="checkbox"/> Selected item drawing <input type="checkbox"/> Altered item drawing				
Inspection of industrial packaging				
Levels of preservation and packing required				
Special or other identification if required				

* FIGURE 6. Drawing evaluation checklist.

- c. Inspection of industrial packing (see 4.5.3).
- d. Levels of preservation and packaging required (see 5.1 and 5.2).
- e. Special or other identification marking, if required (see 5.3.1).

* 6.2.1 For filter types not covered by this specification. Acquisition documents should specify the information on figure 6.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable qualified products list whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is the Naval Electronic Systems Command, ELEX 8111, Washington D.C., 20363, however, information pertaining to qualification of products may be obtained from the Defense Electronics Supply Center (DESC-E), Dayton, Ohio 45444.

6.4 Solder coating. It is intended that solder coatings on parts used for terminals withstand extended storage without deterioration of soldering qualities or appreciable increase in resistance. Pure-tin coatings usually do not store satisfactorily.

6.5 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in those notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
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 Navy - EC
 Air Force - 85

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 Navy - EC
 (Project 5915-0285)

Review activities:
 Army - AR, MI
 Navy - SH
 Air Force - 11, 17, 99
 DLA - ES

User activities:
 Army - AT, AV, ME
 Navy - AS, MC, OS, YD
 Air Force - 19

Agent:
 DLA - ES

APPENDIX

PROCEDURE FOR QUALIFICATION INSPECTION

10. SCOPE

10.1 Scope. This appendix details the procedure for submission of samples, with related data, for qualification inspection of filters covered by this specification. The procedure for extending qualification is also outlined herein. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance only.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. SUBMISSION

30.1 Sample. A sample consisting of 19 specimens of each filter for which qualification is sought shall be submitted. Each sample shall be accompanied with the following information:

- a. Attenuation curve in accordance with MIL-STD-220.
- b. Certification as to the flashpoint of the impregnant or potting compound based on the Cleveland-cup process (see 4.6.12).
- c. Schematic diagram of the filter, including nominal values of the components.

30.2 Certification of material. When submitting samples for qualification, the manufacturer shall submit certification, in duplicate, that the materials used in the filters are in accordance with the applicable specification requirements.

30.3 Description of items. The manufacturer shall submit a detailed description of the filters being submitted for tests, including the type and quantity of impregnant, material, thickness, and applied finish of case, and details of terminal.

40. EXTENT OF QUALIFICATION

40.1 Extent of qualification. Extent of qualification shall only be applicable for filters covered by the same specification sheet. Qualification for one filter may be the basis for qualification of another filter as indicated below:

- a. Voltage rating - Extent of qualification shall be restricted to filters of the same voltage rating.
- b. Current rating - Qualification of the lowest current rating and highest current rating for a given specification sheet and circuit diagram will extend qualification for all intermediate current ratings.
- c. Circuit diagram - As indicated in table XV.

TABLE XV. Extent of qualification for circuit diagram.

Qualification of circuit diagram	Will qualify circuit diagram
C	C
T	T, L1, L2
L1	L1, L2, C
L2	L1, L2, C
Pi	Pi, L1, L2, C
2L1	2L1, 2L2, Pi
	L1, L2, T, C
	2L1, 2L2, Pi
2L2	L1, L2, T, C

- d. Capacitance - Capacitance range qualification for a given specification sheet, mounting thread series, and circuit diagram will be restricted to values equal to and less than the capacitance value submitted (for example qualification of a 5000 pF GMY filter will extend qualification to the 1000 pF GMY filter on the same specification sheet, with the same mounting thread series, and the same circuit diagram).

As a requisite for extension of qualification, the product involved must be manufactured using the same facilities, processes, and materials as the product originally submitted for qualification.

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER
MIL-F-15733G

2. DOCUMENT TITLE
Filters and Capacitors, Radio Frequency Interference, General

3. NAME OF SUBMITTING ORGANIZATION Specification For

4. TYPE OF ORGANIZATION (Mark one)

☐

VENDOR

☐

USER

☐

MANUFACTURER

☐

OTHER (Specify) _____

5. ADDRESS (Street, City, State, ZIP Code)

5. PROBLEM AREAS

a. Paragraph Number and Wording

b. Recommended Wording

c. Reason/Rationale for Recommendation

6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) - Optional

b. WORK TELEPHONE NUMBER (Include Area Code) - Optional

c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional

8. DATE OF SUBMISSION (YYMMDD)

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